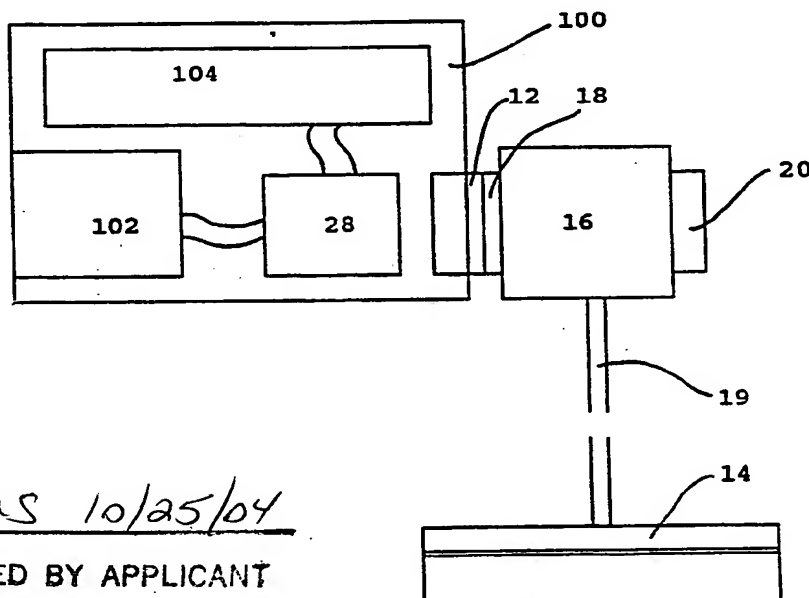




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : G06F 1/00	A2	(11) International Publication Number: WO 90/12357 (43) International Publication Date: 18 October 1990 (18.10.90)
<p>(21) International Application Number: PCT/GB90/00478</p> <p>(22) International Filing Date: 30 March 1990 (30.03.90)</p> <p>(30) Priority data: 8907412.4 1 April 1989 (01.04.89) GB</p> <p>(71) Applicant (for all designated States except US): NIGHT-HAWK ELECTRONICS LIMITED [GB/GB]; 36 Essex Street, London WC2R 3AS (GB).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only) : MURRAY, Douglas [GB/GB]; College Lands, 153 Bell Street, Glasgow G4 0DT (GB).</p> <p>(74) Agent: GILL JENNINGS & EVERY; 53/64 Chancery Lane, London WC2A 1HN (GB).</p>		<p>(81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), NO, SE (European patent), US.</p> <p>Published <i>Without international search report and to be republished upon receipt of that report.</i></p>

(54) Title: **COMPUTER SECURITY SYSTEM**US 10/25/04
CITED BY APPLICANT

(57) Abstract

A security system for a computer (10) having at least one communications port (12) for connection to peripheral devices, includes a card reader (14). A switching means (22) connected to the card reader and connectible to the communications port, is operable to connect the card reader to the communications port in response to a command including protected routines which generate said command to cause the switching means to connect the card reader to the communications port. Suitable software compares data from a card read by the card reader with authorisation data held in the computer, to enable or disable further operation of the protected routine(s).

+ See back of page

REF. 1 DOCKET P263034
 CORRES. COUNTRY: GB
 COUNTRY: PCT

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COMPUTER SECURITY SYSTEM

This invention relates to a means of restricting access to computer files.

5 The large amount of confidential data on files held by many computers and the expense involved in accessing outside data systems via a modem, makes it imperative to ensure that access to such data and systems is restricted to certain authorised users. At present one of the usual
10 methods of restricting access involves entering a code via the keyboard. However, as the computer must contain a program which recognises the code, an expert can gain entry to the data files by calling up and then modifying the program. It is also possible to provide a mechanical lock
15 system, but this is not a practical means of controlling a variety of levels of authorised access to given types of data or peripherals.

 According to the present invention there is provided a security system for a computer having at least one
20 communications port for connection to peripheral devices; the system having a card reader; switching means operable to connect the card reader to the communications port in response to a command including protected routines which generate said command to cause the switching means to
25 connect the card reader to the communications port; and means for comparing data from a card read by the card reader with memorised authorisation data to enable or disable further operation of the protected routine.

 Preferably, the switching means operates to connect
30 the card reader and a peripheral device alternatively to a single communications port.

 In a particularly preferred form, the switching means is comprised in an adapter package which includes a plug for connection into a communications port socket, a socket
35 for receiving a peripheral device plug, and a cable connection to a stand-alone card reader.

Preferably, said computer is an IBM personal computer (or compatible) having a hard disk drive, and the usual serial communication port.

5 The card reader is preferably a swipe reader, having two of the three standard outputs i.e. CLOCK negative logic and DATA negative logic. These two outputs connect to two inputs in the computer via the switching means. The inputs in the computer (which usually connect with two data set inputs) may thus be controlled by the switch means, which
10 in turn is controlled by the software system.

The software system may be made up of various files e.g. a system file, an installation file and a utility file. These allow access to the computer when the card is used at various levels of security.

15 The software system controls the switch means by setting output levels and monitoring input signals by polling the input signals and processing the changes as the card is swiped. It is possible to use interrupts instead of polling.

20 The above system may be used with the usual communication port uses e.g. to modem, mouse or serial printer.

In order to ensure that the security software cannot be circumvented, access to floppy disc drives on the
25 computer is preferably prevented. This may be achieved by inserting a circuit board between the computer's main system board and the floppy disc drive, to intercept the disc control signals and prevent access to the disc drive until a specified control sequence is received on the disc
30 drive interface from the controlling software. This control sequence is arranged to be sent only once the user has been authenticated on the system. An embodiment of the invention will now be described by way of example, with reference to the accompanying drawings, in which:

35 Fig. 1 is a perspective view of a computer system;

Fig. 2 is a block diagram of the computer system illustrating a card reader and adapter used in the system of the invention; and

5 Fig. 3 is a block diagram of the circuitry of the adapter.

The preferred embodiment makes use of an IBM PC (or compatible computer) 10 having a communications port socket 12 and a floppy disk drive 102, and a card reader 14. The card reader 14 is permanently wired by cable 19 to an
10 adapter 16 which has a plug 18 for engagement in the communications port socket 12 and also has a similar socket 20 into which any desired peripheral device (not shown) may be connected.

The card reader 14 is a standard swipe reader meeting
15 ISO 3554 track two standard; it requires 0 volt and 5 volt electrical supplies and its outputs are:-

1. CARD PRESENT negative logic.
2. CLOCK negative logic.
3. DATA negative logic.

20 The way that data is retrieved in all systems employing such readers is that data is formed by the data signal being present or not during a 'clock' signal transition from high to low. Each transition is one bit and 5 bits equal one digit plus parity, the lower 4 bits
25 equal a binary coded decimal number. The 'card present' signal signals the start and end of the card information. The system described here uses only CLOCK and DATA signals.

In order to ensure that the security software cannot be circumvented, access to the floppy disc drive 102 in the
30 computer is prevented by means of a circuit board 28 inserted between the computer's main system board 104 and the floppy disc drive 102, to intercept the disc control signals and prevent access to the disc drive until a specified control sequence is received on the disc drive
35 interface from the controlling software. This control sequence is arranged to be sent only once the user has been authenticated on the system. For this purpose a single GAL

chip is used on the circuit board to intercept the control signals and to decode the enable sequence. The GAL chip may include a security fuse to ensure that its contents cannot be read out. Once the enable or disable signal is received, the GAL does not respond to any further commands. This stops experimentation by potential hackers.

Referring to Fig. 3, the IBM PC or compatible serial communication port 12 (termed COM 1 to COM 4) has 3 outputs and 5 inputs which are used to connect to data set equipment. To allow the card CLOCK and DATA signals to connect to two inputs, the adapter 16 has an electronic switch 22 which is employed to disconnect two data set inputs and connect the two card signals. The switch 22 is activated by the PC setting two of its outputs to a level which is inconsistent with normal data set equipment, i.e. Request To Send (RTS) signal = OFF and Transmit (TX) signal = ON. This condition is sensed by switch logic 24 to operate switch 22, thus connecting the card signals to the inputs Carrier Detect (CD) and Clear To Send (CTS).

The 5 volt power requirement for the card reader 14 and the electronic switch 22 is derived from the output signal Data Terminal Ready (DTR) via a voltage regulator 26. The input signals for the card reader, CTS and CD, could be any input except Receive (RX). It is the function of a software driver program SECURITY.SYS to activate the switch by setting the defined output levels and to monitor input signals by polling the input signals and processing the changes as the card is swiped. It is possible to use interrupts instead of polling.

It will be appreciated that in normal use of the computer, the communications port operates normally with any peripheral device connected to the adapter socket 20. It is only when the software calls for a security verification by setting RTS = OFF and TX = ON that the peripheral is disconnected and the card reader 14 is connected.

The card itself may contain a total of 40 digits. The first digit and the last two digits are start sentinel, end sentinel and check digit respectively, leaving 37 digits which the software driver passes to a CARD CHECK program.

5 The digits are used to identify a particular user. Data is held on the computer to define the following items for each user:-

1. Card Number
2. Privilege Level Number
- 10 3. User Name
4. PUN requirement
5. Floppy drive access permission

where the following definitions are used:

15 CARD NUMBER: Any time the CARD CHECK program is called, it will not allow the user to continue unless this number on the card matches an entry in a preprogrammed table of numbers. As the CARD CHECK program is called at 'power up', only specified cards can enable the system to operate.

20 USER GROUP No: After 'power up', PCs and compatibles are capable, through the AUTOEXEC.BAT file, of executing one application directly, without input from the user. The program CARD CHECK, when used in an AUTOEXEC.BAT file, return an ERROR LEVEL number equal to this number to the AUTOEXEC.BAT file. It is possible to process this number to execute one of 9999 applications directly from 'power up'.

30 PRIVILEGE LEVEL NO: Its main function is to provide the ACCESS LEVEL to a program/file which has been LOCKED using a utility program LOCK.COM. Programs/files which have been LOCKED are not usable (even when copied) unless the DRIVER returns a PRIVILEGE LEVEL equal to or

35

higher than that applied to the program/file when LOCKED. It is also used to restrict access to the user setup program.

5 PUN Requirement: This defines whether or not a PUN is required for this user. Using the card and a MACHINE KEY NUMBER (pre-programmed), an algorithm produces a four digit PERSONAL USER NUMBER. The
10 CARD CHECK program can ask the user to input this PUN and a comparison is made before returning to the application. This feature may also be a KEY to unLOCK programs/files which
15 have this key applied when LOCKED.

 The software module is installed in the computer memory at 'power up' through the CONFIG.SYS file and communicates with the card reader on 'power up' and on request by an application. The software may comprise a
20 number of files, for example a system file; an installation file and various utility files. These may be made up and operate as follows:

System file	:	SECURITY.SYS
Installation file	:	INSTALL.COM
25 Utility files	:	CARD.COM
		CARD2.COM
		INCARD.COM
		PUNCARD.COM
		LOCK.COM
30		UNLOCK.COM

SECURITY.SYS: This is a system file (DRIVER) which is loaded from the CONFIG.SYS file at 'power up'. This software accepts a request via a DOS interrupt and returns card data to the
35 calling program when the request has been executed. Valid requests are:-

7

1. Return card data from the last card input.
 2. Return card data from a new valid card input.
 - 5 3. Ask for PUN on the last card input and return card data if the PUN is valid.
 4. Ask for the PUN on a new valid card input and return card data if both the
 - 10 card and PUN are valid.
 5. As in request 4, but returns without checking the PUN and with the PUN appended to the card data.
- (A valid card is defined as having the correct User Group ID.)
- 15 INSTALL.COM: This program allows the user to define the USER GROUP IDENTITY NUMBERS and insert them into the DRIVER prior to installing on the hard disk. It also allows the MACHINE KEY
- 20 NUMBER to be input and also the facility to disable a PUN input at power up. A view facility allows the user to view details on a driver already installed on disc and to create PERSONAL USER NUMBERS relative to a
- 25 MACHINE KEY NUMBER.
- CARD.COM: A program which, when used in a batch file, will return an ERROR LEVEL number equal to that defined as the BATCH NUMBER on the last card input.
- 30 CARD2.COM: As defined in CARD.COM but returns the PRIVILEGE LEVEL NUMBER as the ERROR LEVEL.
- INCARD.COM: A program which requires the input of a new card before returning an ERROR LEVEL as defined in CARD.COM.
- 35 PUNCARD.COM: As defined in CARD.COM but requires the input and validation of a PERSONAL USER NUMBER before returning.

LOCK.COM: This program will alter files with the extension .EXE or .COM making them usable in an environment without a 'PC SECURITY.SYS' system installed. In addition it tags the file with a PRIVILEGE LEVEL number and KEY. The KEY the file with defines how to derive the user's PRIVILEGE LEVEL when the program is executed.

5

10 Security level:

KEY 01 - from last card input
02 - from a new card input
03 - from last card when valid PUN input
15 04 - from a new card when valid PUN input

The program will execute only when the user's security level is equal to or higher than that on the TAG.

20 UNLOCK.COM: Restores locked files to their original form.

Other file arrangements may be used. Detailed implementations of software for carrying the invention into effect will be readily apparent to those skilled in the art.

25

The invention thus allows a conventional computer to be modified in a simple manner to provide a system with a high degree of security which may operate in a versatile manner.

30

CLAIMS

1. A security system for a computer (10) having at least one communications port (12) for connection to peripheral devices, the security system comprising:
- 5 a card reader (14);
- switching means (22) connected to the card reader and connectible to the communications port, the switching means being operable to connect the card reader to the communications port in response to a command including protected routines which generate said command to cause the
- 10 switching means to connect the card reader to the communications port; and,
- means for comparing data from a card read by the card reader with authorisation data held in the computer, to
- 15 enable or disable further operation of the protected routine.
2. A system according to claim 1, wherein the switching means (22) operates to connect the card reader and a peripheral device alternatively to a single communications port (12).
- 20
3. A system according to claim 1 or claim 2, wherein the switching means (22) is provided in an adapter (16) which includes a plug (18) for connection to a communications port socket (12), a socket (20) for receiving a peripheral device plug, and a cable connection (19) to the card reader.
- 25
4. A system according to any of claims 1 to 3, wherein the card reader is a swipe reader having two of the three standard outputs i.e. CLOCK negative logic and DATA negative logic, the two outputs connecting, in use, to two
- 30 inputs in the computer via the switching means, whereby the inputs in the computer (which usually connect with two data set inputs) may be controlled by the switch means.
- 35

5. A system according to any of claims 1 to 4, wherein the means for comparing data from a card read by the card reader with authorisation data held in the computer, comprises software held, in use, in the computer.
- 5
6. A system according to any of claims 1 to 5, further including means (28) for preventing access to floppy disc drives on the computer, the means comprising a circuit board insertable between the computer's main system board (30) and its floppy disc drive (32), to intercept the disc control signals and prevent access to the disc drive until a specified control sequence is received on the disc drive interface from the controlling software.
- 10
7. A computer system (10) having at least one communications port (12) for connection to peripheral devices, and including a security system according to any of claims 1 to 6.
- 15

1/2

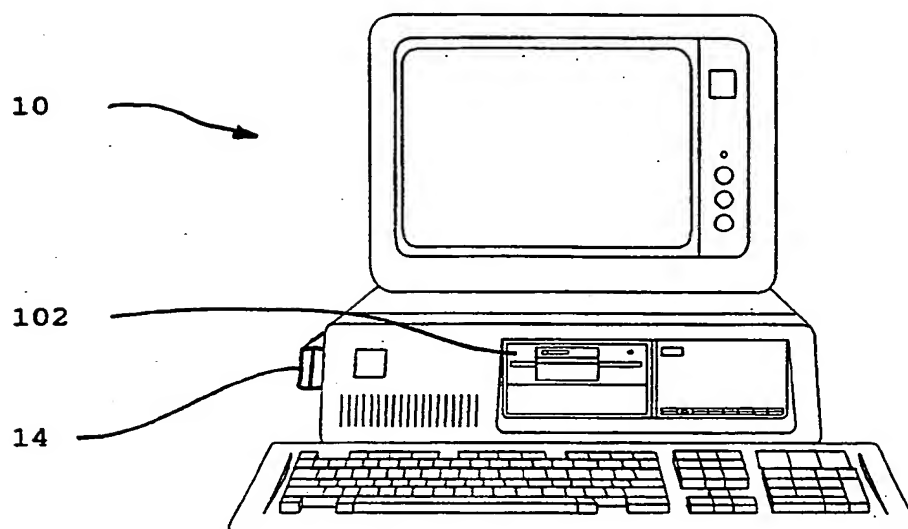
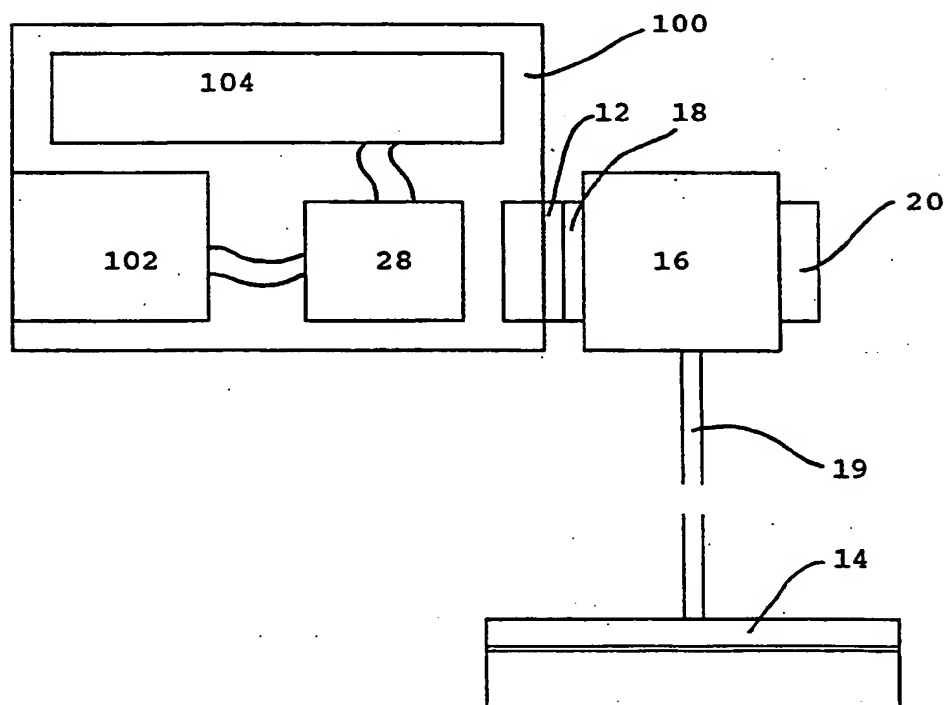


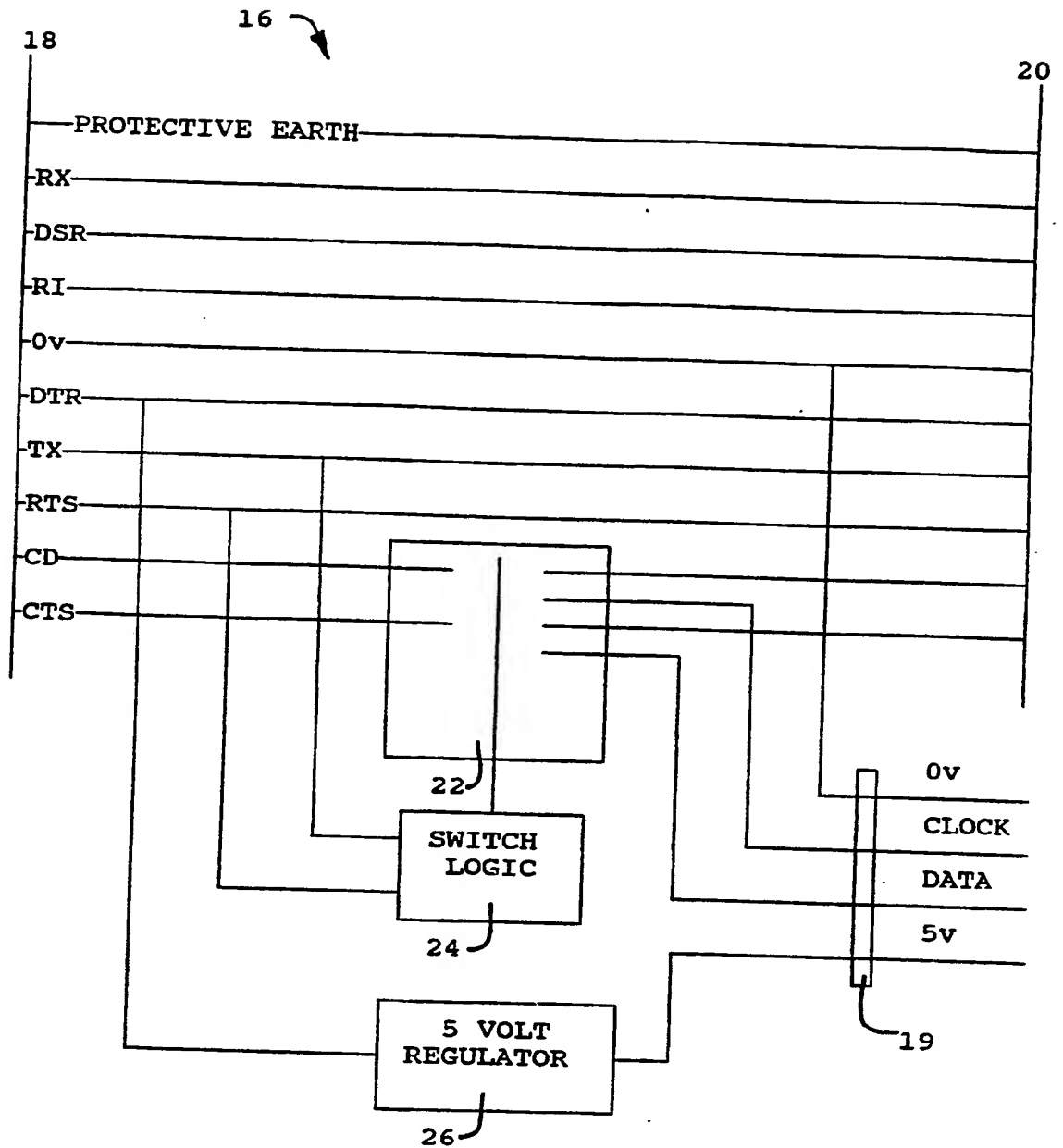
FIGURE 1

FIGURE 2



2/2

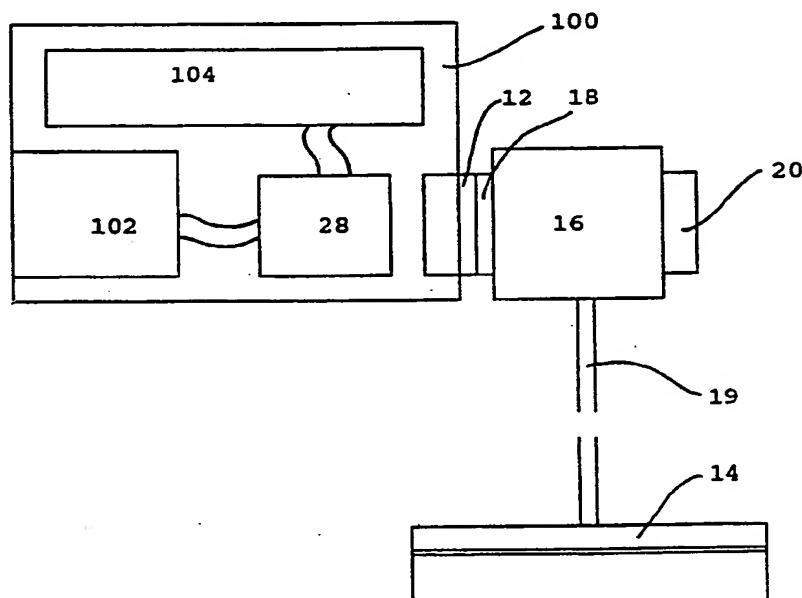
FIGURE 3





INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : G06F 1/00, 3/08		A3	(11) International Publication Number: WO 90/12357
			(43) International Publication Date: 18 October 1990 (18.10.90)
(21) International Application Number: PCT/GB90/00478 (22) International Filing Date: 30 March 1990 (30.03.90) (30) Priority data: 8907412.4 1 April 1989 (01.04.89) GB (71) Applicant (for all designated States except US): NIGHT-HAWK ELECTRONICS LIMITED [GB/GB]; 36 Essex Street, London WC2R 3AS (GB). (72) Inventor; and (75) Inventor/Applicant (for US only) : MURRAY, Douglas [GB/GB]; College Lands, 153 Bell Street, Glasgow G4 0DT (GB). (74) Agent: GILL JENNINGS & EVERY; 53/64 Chancery Lane, London WC2A 1HN (GB).			(81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), NO, SE (European patent), US. Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> (88) Date of publication of the international search report: 15 November 1990 (15.11.90)

(54) Title: **COMPUTER SECURITY SYSTEM**

(57) Abstract

A security system for a computer (10) having at least one communications port (12) for connection to peripheral devices, includes a card reader (14): A switching means (22) connected to the card reader and connectible to the communications port, is operable to connect the card reader to the communications port in response to a command including protected routines which generate said command to cause the switching means to connect the card reader to the communications port. Suitable software compares data from a card read by the card reader with authorisation data held in the computer, to enable or disable further operation of the protected routine(s).

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INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 90/00478

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC ⁵ : G 06 F 1/00, G 06 F 3/08														
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched ⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%; text-align: left; border-bottom: 1px solid black;">Classification System ¹</th> <th style="width: 75%; text-align: left; border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="padding: 5px;">IPC⁵</td> <td style="padding: 5px;">G 06 F 1/00, G 06 F 3/08</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸</div>			Classification System ¹	Classification Symbols	IPC ⁵	G 06 F 1/00, G 06 F 3/08								
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III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; text-align: left; border-bottom: 1px solid black;">Category ⁹</th> <th style="width: 70%; text-align: left; border-bottom: 1px solid black;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 20%; text-align: left; border-bottom: 1px solid black;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">US, A, 4799153 (HANN) 17 January 1989 see figures 17,18; column 20, line 34 - column 22, line 2 --</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-5,7</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">WO, A, 88/03287 (HARCOM SECURITY) 5 May 1988 see figures 1-3,6; page 7, line 33 - page 8, line 30; page 12, lines 2-16; page 20, line 34 - page 22, line 21 --</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,4-7</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">IBM Technical Disclosure Bulletin, vol. 22, no. 4, September 1979, (New York, US), D.W. Cooper et al.: "Removal of contention for card deck resource", pages 1334-1335 see the whole article -- ./.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1</td> </tr> </table>			Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	US, A, 4799153 (HANN) 17 January 1989 see figures 17,18; column 20, line 34 - column 22, line 2 --	1-5,7	A	WO, A, 88/03287 (HARCOM SECURITY) 5 May 1988 see figures 1-3,6; page 7, line 33 - page 8, line 30; page 12, lines 2-16; page 20, line 34 - page 22, line 21 --	1,4-7	A	IBM Technical Disclosure Bulletin, vol. 22, no. 4, September 1979, (New York, US), D.W. Cooper et al.: "Removal of contention for card deck resource", pages 1334-1335 see the whole article -- ./.	1
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"G" document member of the same patent family</p> </div> </div>														
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> Date of the Actual Completion of the International Search <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">4th September 1990</div> </td> <td style="width: 50%; padding: 5px;"> Date of Mailing of this International Search Report <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">27.09.90</div> </td> </tr> <tr> <td style="width: 50%; padding: 5px;"> International Searching Authority <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">EUROPEAN PATENT OFFICE</div> </td> <td style="width: 50%; padding: 5px;"> Signature of Authorized Officer <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Mme N. KUIPER </div> </td> </tr> </table>			Date of the Actual Completion of the International Search <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">4th September 1990</div>	Date of Mailing of this International Search Report <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">27.09.90</div>	International Searching Authority <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">EUROPEAN PATENT OFFICE</div>	Signature of Authorized Officer <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Mme N. KUIPER </div>								
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, " with indication, where appropriate, of the relevant passages	Relevant to Claim No.
P,A	EP, A, 0314530 (MICROPHAR) 3 May 1989 see the abstract; figures 1-4 & FR, A, 2618926 (3 February 1989) --	1,3
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